

CLAIMS

1. A Fresnel lens sheet comprising:

a flat base part;

a plurality of prisms formed on an entrance surface of the base part, each of the prisms having a refraction facet that refracts light rays fallen thereon and a total-reflection facet that totally reflects light rays fallen thereon;

a plurality of V grooves formed in an exit surface of the base part; and

a plurality of wedge-shaped light absorbing parts embedded in the V grooves, respectively, the light absorbing parts having a refractive index lower than that of the base part;

wherein at least some of the light rays refracted and totally reflected by prisms are reflected by the inclined surfaces that are interfaces between the base part and the light absorbing parts embedded in the grooves of the base part, so that light rays travel outside through regions of the exit surface of the base part the regions being placed between adjacent light absorbing parts.

2. The Fresnel lens sheet according to claim 1, wherein two inclined surfaces of each of the light absorbing parts are symmetrical with respect to a direction perpendicular to the base part, and a condition expressed by:

$$\tan^{-1} (2D/W_1) \geq \sin^{-1} (N_1/N_2),$$

where N_1 is a refractive index of the light absorbing parts, N_2 is a refractive index of the base part, D is a depth of the light absorbing parts (length along a thickness of the base part), and W_1 is a width of the light absorbing parts (length on the exit surface of the base part along a direction perpendicular to a direction in which the light absorbing parts extend), is satisfied.

3. The Fresnel lens sheet according to claim 1 or 2, wherein a ratio W_1/D , where D is a depth D of the light absorbing parts (length along a thickness of the base part), and W_1 is a width of the light absorbing parts (length on the exit surface of the base part along a direction perpendicular to a direction in which the light absorbing parts extend), is in a

range of 0.05 to 0.5.

4. The Fresnel lens sheet according to claim 1, wherein two inclined surfaces of each of the light absorbing parts are asymmetrical with respect to a direction perpendicular to the base part, and conditions expressed by:

$$\tan^{-1} (D/W_3) \geq \sin^{-1} (N_1/N_2)$$

$$\tan^{-1} (D/W_4) \geq \sin^{-1} (N_1/N_2),$$

where N_1 is a refractive index of the light absorbing parts, N_2 is a refractive index of the base part, D is a depth of the light absorbing parts (length along a thickness of the base part), W_3 is a width of a projection of one of inclined surfaces of each of the light absorbing parts on the exit surface (length on the exit surface of the base part along a direction perpendicular to a direction in which the light absorbing parts extend), and W_4 is a width of a projection of the other inclined surface of each of the light absorbing parts on the exit surface (length on the exit surface of the base part along a direction perpendicular to a direction in which the light absorbing part extends), are satisfied.

5. The Fresnel lens sheet according to claim 1 or 4, wherein W_3/D is in a range of 0.025 to 0.25 and W_4/D is in a range of 0.025 to 0.25, where D is a depth of the light absorbing parts (length along a thickness of the base part), W_3 is a width of a projection of one of inclined surfaces of each of the light absorbing parts on the exit surface (length on the exit surface of the base part along a direction perpendicular to a direction in which the light absorbing part extends), and W_4 is a width of a projection of the other inclined surface of each of the light absorbing parts on the exit surface (length on the exit surface of the base part along a direction perpendicular to a direction in which the light absorbing parts extend).

6. The Fresnel lens sheet according to any one of claims 1 to 5, wherein portions of the light absorbing parts, within a distance of 0.1 μm from the inclined surfaces contiguous with the base part have an OD (optical density) in a range of 0.01 to 0.12.

7. The Fresnel lens sheet according to any one of claims 1 to 6, wherein the light absorbing parts entirely have a substantially uniform absorptance and an OD (optical density) per 1 μm in thickness of the light absorbing parts is in a range of 0.1 to 1.2.

8. The Fresnel lens sheet according to claim 6, wherein the light absorbing parts are formed of a material prepared by dispersing spherical light absorbing particles in a transparent base material, and a mean particle size of the spherical light absorbing particles is in a range of 2 to 15 μm .

9. The Fresnel lens sheet according to any one of claims 1 to 8, further comprising an antireflection layer formed on either of the entrance surface and the exit surface of the base part.

10. A rear projection screen comprising:

the Fresnel lens sheet according to any one of claims 1 to 9; and

a lenticular sheet placed on a viewer's side of the Fresnel lens sheet to diffuse light passed through the Fresnel lens sheet.

11. The rear projection screen according to claim 10, further comprising an antireflection layer formed on either the entrance surface of the Fresnel lens sheet or the exit surface of the lenticular sheet.

12. A rear projection display comprising:

a rear projection screen provided with the Fresnel lens sheet according to any one of claims 1 to 9; and

a projector that projects image light rays obliquely onto the rear projection screen.

13. A rear projection display comprising:

the rear projection screen according to claim 10 or 11; and

a projector that projects image light rays obliquely onto the rear projection screen.